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RESULTS FROM EXPLOITATION RESEARCH AND QUALITY OF WORK IN SEMI AUTHOMATIC TRANSPLANTING OF INDUSTRIAL TOMATO

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ABSTRACT

In each production technology in planting of industrial tomatoes, farmers tend basically is to broadcasting material planned number of plants per hectare. There are a number of factors affecting plant and to accept the planned number of plants, but always great importance has machines that enable planting. Constantly we make new constructions and improuved technical solutions that are characterized by high precision, productivity, allowing planting for a shorter time and in optimal weather conditions. The need for mechanic workflows due as a result of the increasing shortage of labor, but also by poor execution of business processes as a result of insufficient education and advocacy workers. In this paper we will be presenting the results of the examination of the exploitation characteristics of machine for semi authomathic transplanting the tomato industry, the production conditions and quality testing of the machine operation.

KEYWORDS: machine transplanting, seedlings, exploitation, productivity.

INTRODUCTION

Tomatoes can be grown both outdoors and in protected areas. indoor production creates higher costs because the space needs to be heated and thus the production cost of tomatoes is higher (Parađiković, 2009). Due to the lack of labor, tomatoes are now increasingly grown on substrates, as this method of cultivation requires less labor, but production is higher in percentage than cultivation in the classical way (Borošić at al., 2011). Tomatoes are due to their nutritional value, which is why today more and more is present in the diet of man as a fresh product, as a processing. The industry is growing on a daily basis, as is the demand for raw materials, and as a result, the areas planted with industrial tomatoes are increasing every day, the techniques and technologies of cultivation are being improved, which allows increasing the yields per hectare. Tomato cultivation should be for light soils, always with an irrigation system installed, depending on the manufacturer's capabilities. Tan at al. (2009) states in the results of his research that the yield of industrial tomatoes increases if grown on lighter irrigated soils, from 42 to 47%, while on heavy soils yields with the same technology increase from only 26 to 35%. R. N. Macedonia has ideal areas for growing industrial tomatoes and the planted areas with this crop are increasing year by year. The process of transplanting industrial tomatoes requires the greatest presence of labor, which is why new lines of machines are being introduced to reduce human working hours.

MATERIAL AND METHODS

The purpose of the tests was to examine the operating parameters of the machine, the quality of work, and the economic parameters when planting container seedlings from different hybrid varieties of industrial tomatoes.

The tests were performed in production conditions on the areas owned by ZZ Ovostar v. Argulica, municipality of Karbinci in the area of the village Gorni Balvan. The tests were performed with the SKR Semi-Automatic Seedling Machine, manufactured by Thermoplin. The machine was purchased with an order for container planting of industrial tomato varieties ROCKER, UG-3186, and Mongeni. The machine in the basic construction has three batteries (sections) with the possibility of regulating the intermediate distance from 50 to 150 cm, at the same time with the planting, a drip system was installed. Basic technical data of the machine: total mass empty 500 kg, total length 270 cm, width 390 cm, number of batteries 3,with drawal power 70 kilowatts, height 200 cm, combined regulation.

The area where the transplant was carried out was a soil type of resin, well-treated, twice plowed and cultivated well-aligned, in some places there was a small stone of different sizes. At the time of transplanting the soil moisture in the layer of 1-10 cm was 32 to 36%. The weather conditions were ideal at an average daily temperature in the range of 18 to 23 degrees, cloudy with a relative humidity of about 60%. The seedling was in good condition with an equal size, it belonged to the first class of three varieties of hybrids. The nursery was towed by a Renault tractor with a towing capacity of 70 kilowatts.

Transplant the seedling to the field 3 to 6 weeks after sowing. A week before transplanting, seedlings should be hardened by reducing theapplication of water, but 12-14 hours before they are taken out of the seedbed they should be thoroughly watered again to avoid excessive damage to the roots. Seedlings of 15-25 cm tall with 3-5 true leaves are most suitable for transplanting. Transplanting should be done inthe afternoon or on a cloudy day to reduce the transplanting shock (Naika at al., 2009).

Tomato seedlings were pre-prepared for transplanting, in excellent condition, with an average height of 12 cm, with an average root length of 6 cm, or a total seedling length of 18 cm. The seedling was container production, and there were 150 plants in one container. Soil moisture ranged from 32-36% during planting (measured with a moisture meter).

During the examinations we used different methods of examinations, as follows:

In the first group of exploitation tests we performed measurements of the most basic parameters in production conditions with at least five repetitions. We measured the working speed as the most basic parameter according to the method of 100 meters, and we made the calculation according to the method of the past time per unit time. Work was measured from the far left to the far right, as the row was three rows long, with a planting distance of 1.5 meters and a height of 0.20 centimeters, which was about 34,000 plants per hectare. During the working day we did a chronograph for 8 hours.

For the quality of work we made measurements by counting a distance of 100 meters with five repetitions, during which we divided the plants into groups, properly planted, improperly planted, damaged, but even after seven days of transplanting we performed re-control by counting for accepted and unacceptable plants (Davcev, 2019).

In order for the examinations to be complete during the methodological placement of the examinations, we made complete recordings for all work operations, hired drive and connecting machines, as well as direct and auxiliary workers, for one shift of 8 hours and with a standard calculation method we determined the total costs arising for one shift in the established organization of work during planting.

RESULTS AND DISCUSSION

During the planting, the batteries were at a distance of 1.5 meters from each other and the regulation of the planting machine was 0.2 and 20 centimeters, respectively. During this regulation, about 34,000 plants were planted per hectare. The regulation was at these distances with a proposal for machine harvesting, ie adaptation of the intermediate distance according to mechanized harvesting. The measurements made during the multi-repeated surveys at a distance of 100 meters concluded that an average of 500 seedlings were planted, which is a theoretical basis for the regulation of machinery.

Of that number of measurements we made in the field, 431 numbers were planted, and 69 numbers were omitted due to the average number of 6 repetitions of all batteries, which is different from the number of batteries due to as a result of the speed and agility of the worker himself. The missing places average number 69, in percentage amount is 13.8%. The abandoned plants were additionally bored by hand and each worker in the row was bored and the order was completely fulfilled. During the work in some rows we noticed improperly placed seedlings and from the measurements with 5 repetitions it was 6 numbers, or in percentage amount 1.2%. We noticed that improper planting of a certain number of plants was due to an obstruction from the stones where the device for inserting the seedlings was properly placed, correctly placed the seedlings. However, in the event that the clip for insertion into the open groove hit the stone, the seedling was inserted into a distorted shape.

The number of broken plants in some types of machines occurs as a result of the quality of the seedling, but also by the occupation of the plant by the seedling. When transplanting the Thermoplin machine, we did not have such a case, because the worker who placed the seedlings in the machine was helped by another worker who took the plants out of the container without breaking the root of the peat and put them in the machine and we did not notice any damage.

The results shown in Table 1 are due to three seedlings. three assistants, a container supplier, a tractor driver and a controller, and three correctors and manual boredom machines. During the manual transplantation, the workers filled in the outgrown plants, which were in different numbers in the three rows, which depended on the speed and the agility of the worker himself. At the same time, they corrected the improperly placed seedlings from the device, which was a very rare case, but as we mentioned before, it was due to a stone obstacle.

During the transplant, a drip system was installed, which was switched on immediately after the end of the working day in order to better accept the seedlings (Naika at al., 2009).

Table 1. Results of measurements for the number of seedlings planted at a distance of 100 meters

No	Description of plants	Number of plants	Percent %
1.	Number of seedlings planted	500	100
2.	Number of improperly planted plants	6	1.2
3.	Number of broken plants	0	0
4.	Number of established plants	69	13.8
5.	Number of properly planted plants	431	86.2

If we analyze the data presented in Table 1, it can be concluded that the machine, ie the unit, does not physically damage the plant, if the operators are trained. From 5 to 7 days after planting, we made an analysis of accepted and dried plants, the results are shown in Table 2.

Table 2. Results of measurements for accepted plants at a distance of 100 meters after 5 days of transplanting

Number of rows	Accepted plants		Unacceptable plants	
	Number of plants	Percent %	Number of plants	Percent %
I	442	100	4	0.90
II	433	100	2	0.46
III	415	100	2	0.48
IV	427	100	0	0
V	436	100	3	0.68

From the results shown in Table 2, it can be concluded that most of the plants planted with the machine are accepted, a small number of about 1% are unacceptable due to damage to insects or a large number of stones in the row.

According to Kukutanov & Canev (2011) Semi-Automatic Seedling Machine, replaces a large number of workers. Semi-Automatic Seedling Machine, can replace 100 workers per day, while the quality of planting is satisfactory and quite fast. Only pre-seedling preparation is required as well as the machine workers. SKR Semi-Automatic Seedling Machine reduces costs by up to 40%, saves time. Productivity ranges from 2 to 4 ha per day.

CONCLUSIONS

Based on the analysis of the obtained results, we can conclude that Semi-Automatic Seedling Machine, replaces a large number of workers, replace up to 100 workers reduces costs by up to 40%, saves time. Productivity ranges from 2 to 4 ha per day. The quality of work is excellent, no plant damage. The productivity of the Semi-Automatic Seedling Machine depends on the skill of the workers and the organization of the work.

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